



White Paper
Dual-Core Intel® Itanium® 2
Processor
Data Center Migration
Business-Critical Infrastructure

Transforming Business-Critical Infrastructure through Migration to Itanium®-Based Servers

A Decision-Maker's Guide to the Benefits, Challenges,
and Available Resources

*"We see nothing but upside from our choice of Intel platforms.
We're saving roughly half the price of UNIX* RISC systems, and
we've got a powerful and flexible foundation to run our business."*
- Doug Gray, IT Director, CompUSA

Executive Summary

Executive Summary	ii
Constant Change: A Fact of Life in Enterprise IT	1
Answering the Challenge with Itanium-based Solutions	1
Better Value for Linux*, Windows*, UNIX, and Mainframe Applications	3
Increasing Performance and Headroom for Linux and Windows Data-tier Applications	4
Reducing Costs with UNIX on Itanium-based Systems	5
Standardizing Proprietary UNIX Environments: Windows	5
Standardizing Proprietary UNIX Environments: Linux	6
Modernizing Mainframe Environments	8
Getting Started	9
Conclusion	10
Sidebar:	
The Challenges of Legacy Software	1
Migration Benefits Continue to Grow	2
Case Studies:	
DuPont	4
CompUSA	5
Lufthansa	6
Hyundai Heavy Industries (HHI)	9
Appendix A:	
Best Practices for Migration	11
Appendix B:	
Additional Resources	12

"The new [Itanium-based] platform gives us the tools and technology to solve our complex IT problems and succeed in this competitive industry."
– Simeon Dimitrov, Department Manager, IT Resources and Administration, Mobitel AD¹

Itanium®-based servers are changing the face of business-critical computing by delivering enterprise-class scalability and availability on a computing architecture that is more flexible and affordable than proprietary RISC and mainframe architectures. The broad range of vendors, operating systems, and applications provides a solid foundation for integration, and enables core enterprise applications to be scaled well beyond the limits of legacy technologies. Large businesses around the world are migrating to Itanium-based systems,² and finding that the move helps to free them from the limitations of proprietary architectures, while improving the economics of their data centers in fundamental ways.

The flexibility and scalability of Itanium-based servers make them ideal for:

- **Scaling up existing Linux* and Windows* applications** to handle heavier workloads, more users, and multi-terabyte datasets.
- **Replacing aging RISC-based systems** with Itanium-based systems (running UNIX*, Windows, or Linux) to increase performance and availability, while reducing costs.
- **Modernizing proprietary mainframe environments** to reduce costs and enable easier integration with new applications. Mainframe-class Itanium-based servers are available that can simultaneously run z/OS*, Linux, and Windows applications.

New tools and resources have emerged that make migration relatively easy across all these scenarios. In many cases, legacy UNIX, mainframe, and IA-32 applications can run without substantial change on Itanium-based systems, and can be managed and maintained using familiar tools and interfaces. Software migrations can then be conducted incrementally, with critical code being ported based on specific cost, benefit, and risk analyses. Proven tools and methods are available for software porting, and in some cases can reduce traditional porting efforts by as much as 90 to 95 percent.

This paper can help you assess the potential value of an Itanium-based migration in your particular environment. It can also help you to begin planning your migration, and direct you to resources that will simplify your move and reduce your risk.

¹ Source: "Mobitel Gears for Growth", an Intel case study: www.intel.com/business/casestudies/mobitel.pdf

² "Based on recent sales data, IDC has recorded gains for Itanium-based servers, with 38% growth in factory revenue from 2004 to 2005 and 42% growth from 1Q05 to 1Q06. There is every reason to expect Itanium to make significant gains in midrange and high-end computing..." Source: "Intel Brings Dual-Core Capabilities to Itanium 2 with Montecito Processor, an IDC Event Flash," by Christopher G. Willard, Ph.D., Matthew Eastwood, Jie Wu, and Addison Snell, July 2006; available for purchase at: www.idc.com/getdoc.jsp?containerId=202865

Constant Change: A Fact of Life in Enterprise IT

"...there are strong reasons for IT organizations to continue migrating servers away from proprietary UNIX platforms."

- Driving Lower TCO and Rapid ROI through UNIX Migrations, Mercer Management Consulting, May, 2006³

Change is a fact of life in enterprise IT. Mergers, acquisitions, and the natural evolution of the marketplace lead to continual and often unpredictable changes in business requirements. At the same time, workloads grow, new technologies emerge, and legacy solutions age, becoming more difficult to adapt and more costly to maintain (see the sidebar, *The Challenges of Legacy Software*).

The complexity and importance of enterprise computing solutions ensure that any path forward involves costs, risks, and challenges. They also ensure that there is no one-size-fits-all solution, because every business has different assets and requirements. Yet despite these differences, the basic goals remain similar across all businesses:

- Maximize the current value of IT assets
- Focus on upgrades and migrations that deliver clear ROI
- Do this while mapping a smooth path to increasing IT capability, flexibility, and cost-effectiveness.

Balancing these three requirements is always challenging. Yet the businesses that do it most effectively achieve a key competitive advantage. They stay ahead of their competition in IT capability, while continually optimizing the total return on their IT investments.

Answering the Challenge with Itanium-based Solutions

"By streamlining the IT environment and ultimately reducing system management cost and dramatically lowering cost of ownership, the IT function is able to return to the front seat of the organization."

- Nathaniel Martinez and Thomas Meyer, IDC⁴

The Challenges of Legacy Software

Custom code running on proprietary operating systems is especially problematic for large businesses. It is costly to maintain, yet difficult to migrate.^a Although no easy solutions are available, tools and technologies are available that provide relief when used as part of a comprehensive migration strategy. Three of the most important are Application Portfolio Management^b (APM), Service Oriented Architecture (SOA), and binary translation, solutions, such as Transitive Corporation's QuickTransit* for Solaris/SPARC-to-Linux/Itanium. APM tools provide a comprehensive and detailed view into application assets; SOA-based technologies simplify the reuse of legacy code in modern environments; and binary translation software enables code developed on one platform to run on another with near native performance (about 80 percent).

With these tools, organizations have better information and more options for modernizing their legacy software assets. Itanium-based systems add additional flexibility, due to their multi-OS capabilities (UNIX, Windows, Linux, z/OS, etc.) and the broad community of vendors targeting various legacy environments.

^a *"The labor to maintain custom-developed applications is the bulk of unknown/unexplained expenses in many of Forrester's client companies. Packaged applications see little of this type of maintenance because the company does not possess the source code."* Source: "Got Legacy? Four Fates Await Your Applications," by Phil Murphy, Forrester, January 10, 2006; Summary available at: <http://www.forrester.com/Research/Document/Excerpt/0,7211,38097,00.html>

^b *"With annual savings reported in the range of 10% to 30% of the IT budget, these [APM] tools are worth serious consideration by any firm with a large percentage of custom-written source code."* Source: "Java, COBOL, and Perl Share a Common Problem," by Phil Murphy, Forrester Research, Inc., November 11, 2005. Available for purchase: <http://www.forrester.com/Research/Document/Excerpt/0,7211,38182,00.html>

Large businesses have long relied on proprietary RISC and mainframe architectures to deliver the high-end scalability and availability needed for business-critical solutions. Those architectures have delivered, but at high cost and with a loss of flexibility and choice due to vendor and technology lock-in.⁵ In today's faster and more demanding business environment, that lack of flexibility can be a serious roadblock to business innovation.

³ Available at: www.migrationforunix.com/futureproof/downloads/mercer-white-paper.pdf

⁴ Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-based Standardization," August 2005: www.itaniumsolutionsalliance.org/news/whitepapers_brochures/CG18M_Web.pdf

⁵ *"...because most of the leading UNIX operating systems are tied to specific lines of server hardware, many users of these systems are finding that their limited deployment options are becoming increasingly burdensome."* Source: "Migrating Business-Critical Applications from UNIX to Windows and Itanium* 2-based Servers," by Ideas International, January 2006. www.itaniumsolutionsalliance.org/news/whitepapers_brochures/06_02_10_UNIX_to_Windows_Migration_FinalFinal_0.pdf

Now Itanium-based systems present a unique opportunity in the history of IT—an affordable, standards-based alternative that meets the most demanding performance, scalability, and availability requirements. These servers support more than 10 operating systems (Windows, Linux, UNIX, z/OS, etc.)⁶ and approximately 11,000 certified applications.⁷ They are supported in turn by a rich, global community of hardware vendors, software developers, and service providers (Figure 1).

This flexibility and broad support can be a key advantage in infrastructure modernization, making it easier to integrate new solutions and upgrades. Customers can migrate incrementally and strategically, they can achieve faster ROI, and they can increase their options and cost-effectiveness going forward. Thousands of companies have already moved to Itanium-based solutions,⁸ and the value of migration has increased substantially with the new generation of servers based on the Dual-Core Intel® Itanium® 2 processor (see the sidebar, *Migration Benefits Continue to Grow*). Most important, new tools and services are emerging that can dramatically simplify migration to Itanium-based systems—even for legacy custom code.

Migration Benefits Continue to Grow

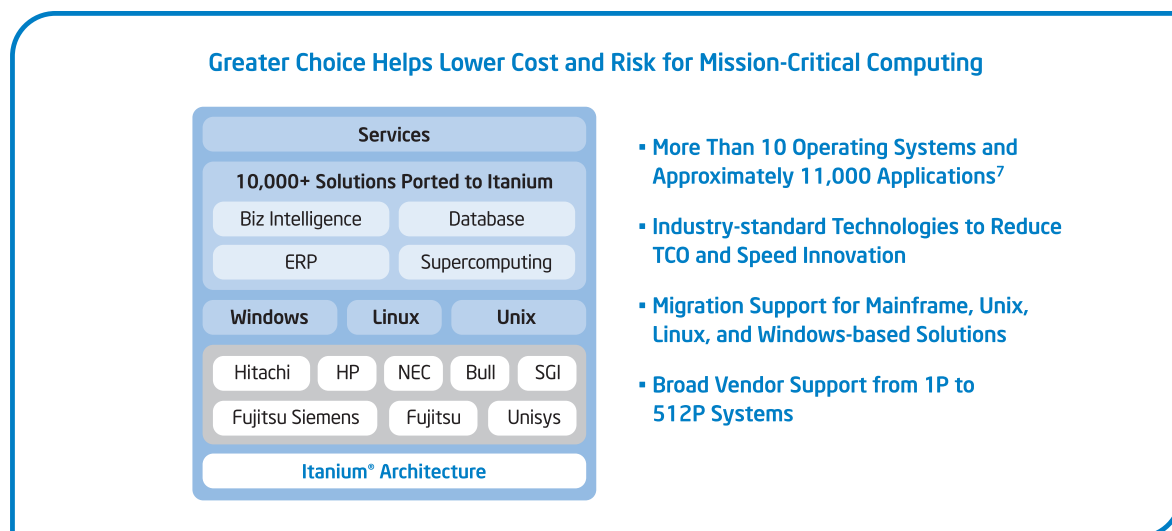
Servers based on the new Dual-Core Intel® Itanium® 2 processor (code-named Montecito) provide another major leap in migration value. The new servers double performance, while reducing power consumption by about 20 percent. These processors feature a larger cache (24 MB per processor), can handle more software threads (4 per processor), and include enhanced, silicon-level support for data protection and virtualization. With these advances, they can substantially improve flexibility and compute density in enterprise data centers, while reducing power and cooling costs.

Intel has four future Intel Itanium 2 processors in development, and a long term roadmap that can be expected to deliver ongoing performance scaling for many years to come. Altogether, the members of the Itanium Solutions Alliance have pledged to invest \$10 billion in Itanium-based solutions through the end of this decade. This investment will help to ensure rapid innovation and provide customers with the highest level of investment protection for their mission-critical solutions.

For more information, visit the Intel Web site at:

www.intel.com/business/bss/products/server/itanium2/index.htm

Figure 1. Itanium-based solutions are bringing choice, flexibility, and affordability to mission-critical computing, enabling tens of thousands of companies to free themselves from the costs and limitations of proprietary RISC and mainframe architectures.



⁶ According to a Forrester Research report, in choosing a strategic system architecture, IT organizations should: "Give a higher weighting to server systems architectures that can equally run applications workloads across a wider breadth of operating system choices—most notably Linux (predominantly Red Hat or SuSE), Windows 2003, and an incumbent Unix variant." Source: "Choosing a Strategic Systems Architecture," by Brad Day, Forrester Research, Inc., June 29, 2006. Available for purchase at: www.forrester.com/Research/Document/Excerpt/0,7211,39702,00.html

⁷ For the latest application numbers, visit the Itanium Solutions Alliance Web site, at: www.itaniumsolutionsalliance.org; for a comprehensive list of applications, see the Itanium Solutions Catalog at: www.itaniumsolutionsalliance.org/kshowcase/view/

⁸ The presence of Itanium-based solutions in the enterprise datacenter is widespread, and growing faster than competing architectures. For more information, see the Intel white paper: "The End of the Proprietary Era": http://download.intel.com/business/bss/products/server/itanium2/proprietary_era.pdf

Better Value for Linux, Windows, UNIX, and Mainframe Applications

“...most of the customers interviewed stated that their business faced barely any disruption in the architecture switch to Itanium...”

– Nathaniel Martinez and Thomas Meyer, IDC⁹

Migration to Itanium architecture offers substantial benefits for a wide range of business-critical enterprise and technical computing applications. The key is to target migration efforts that will deliver the greatest value for the least cost and risk (see Table 1). In general,

Itanium-based systems are best suited to large, enterprise-class database, data warehousing, and business intelligence applications; for core enterprise applications, such as Enterprise Resource Planning¹⁰, Supply Chain Management, and Customer Relationship Management; and for demanding technical and scientific applications that scale most effectively on large, symmetric multiprocessor (SMP) servers.¹¹ In general, Itanium-based systems are an excellent fit for most highly threaded applications, due to the availability of large SMP configurations and the support for Hyper-Threading Technology in the latest Dual-Core Intel Itanium 2 processors.

In all these cases, migrating to Itanium-based systems often can help IT organizations improve performance, scalability, availability,

Table 1. Migrating to Itanium-based Solutions^a

Current Environment	Challenges with Current Environment	Ease of Migration to Itanium-based Solutions	Benefits
Intel Architecture			
Linux*/Windows* on IA-32	<ul style="list-style-type: none"> – Memory Constraints – Scale-up Limitations – Too Many Servers 	<ul style="list-style-type: none"> – Packaged Applications: Quick and Easy – Custom Applications: Requires 64-bit Migration and Recompile 	<ul style="list-style-type: none"> – Better Scale-up Performance (Up to 512 Processors and 1 TB Memory) – Mainframe-class Availability
Linux/Windows on Intel® 64	<ul style="list-style-type: none"> – Scale-up Limitations – Too Many Servers 	<ul style="list-style-type: none"> – Packaged Applications: Quick and Easy – Custom Applications: Simple Recompile 	<ul style="list-style-type: none"> – Better Performance for Highly Threaded Applications – Reduced Operating Costs (Fewer Servers)
UNIX on RISC			
Solaris* on SPARC*	<ul style="list-style-type: none"> – Performance Issues – High Operational Costs – High Upgrade Costs – Vendor/OS Lock-in 	<ul style="list-style-type: none"> – Packaged and Custom Applications: Quick and Easy Using QuickTransit or HP Migration Kits; Migrate to Native Itanium Code If and When Required 	<ul style="list-style-type: none"> – Better Performance – Comparable or Better Scalability/Availability – Broad Support, Flexible Options – Lower TCO
AIX* on Power*	<ul style="list-style-type: none"> – High Operational Costs – High Upgrade Costs – Vendor/OS Lock-in 	<ul style="list-style-type: none"> – Packaged Applications: Medium – Custom Applications: May Require Extensive Code Migration 	<ul style="list-style-type: none"> – Comparable or Better Scalability/Availability – Broad Support, Flexible Options – Lower TCO
Mainframe			
IBM z/OS*	<ul style="list-style-type: none"> – High Costs – Vendor Lock-in – Limited Options – Integration challenges 	<ul style="list-style-type: none"> – All Applications: Straightforward with z/OS Compatible Itanium-based Mainframes (from PSI); Migrate Legacy Applications to Windows or Linux If and When Required 	<ul style="list-style-type: none"> – Mainframe Scalability, Availability, Manageability – Run Legacy Mainframe Applications Alongside Linux and Windows Applications – Greater Flexibility – Lower TCO – Easier Integration

^a The information in this table provides general guidelines only. Every migration is different, and customers are encouraged to conduct a thorough analysis of costs, risks, and benefits before undertaking a complex migration.

⁹ Source: IDC White Paper sponsored by HP, “End-Users’ Feedback: Transform IT and Increase Business Performance Through Itanium-based Standardization,” August 2005: www.itaniumsolutionsalliance.org/news/whitepapers_brochures/CG18M_Web.pdf

¹⁰ For information about ERP migration, see the META Group white paper, “Migrating Unix ERP Installations to a Windows Server Environment: A Qualitative Assessment of Business Impact,” August 2004. <http://download.microsoft.com/download/f/5/f/f5fcd06a-dafd-4f45-ab4d-bdd2da2b2e86/METAGroup.pdf>

¹¹ For information about matching Intel Itanium 2 and Intel Xeon processor-based systems to specific applications and workloads, see the Itanium Solutions Alliance white paper, “Itanium® 2-based Solutions and the x86 Architecture,” available at: www.itaniumsolutionsalliance.org/news/whitepapers_brochures/itanium_and_x86_white_paper.pdf

and manageability; consolidate workloads onto fewer servers and processors; and reduce the total cost of ownership. Major software vendors, such as BEA, Oracle, SAP, SAS, and many others have

proven tools and methodologies that simplify migration to Itanium-based servers. The following sections focus on scenarios for which migration can be particularly valuable.

Case Study: RISC Migration in Action

DuPont

- Migrated 6 RISC architectures to Linux on Intel-based servers
- 4x-5x performance boost; 8x price/performance improvement
- Additional savings expected due to standardization and reduced licensing fees

For more than 200 years, DuPont has relied on its world-class research teams to deliver technology innovation across a wide range of industries. In a move to upgrade its core computing capabilities, the company worked with Intel® Solution Services to confirm the value of migrating its 6 separate RISC architectures to Intel® Itanium® 2 and Intel® Xeon® processor-based servers running Red Hat Enterprise Linux*. According to Tim Mueller, supervisor of DuPont's High-Performance Computing Group, ***"We knew that our current outsourced RISC architecture-based environment was not going to scale to meet our long-term growth needs. And though we wanted greater performance, we also had budget considerations."***

The test results were unequivocal. ***"Not only was the performance of the Intel architecture-based systems impressive, but they cost about half as much as our RISC-based platform."*** On average, the Intel processor-based systems delivered a 4x-5x performance boost, for an 8x improvement in price performance. Additional gains are expected due to standardization of the HPC environment and reduced software licensing fees from running larger workloads on fewer processors.

Read the complete Intel case study at:

www.intel.com/business/casestudies/dupont_datacenter.pdf

Increasing Performance and Headroom for Linux and Windows Data-tier Applications

"With the Itanium 2-based platform, our 64-bit business intelligence solutions deliver the accountability and reliability it takes to make critical decisions around more than \$15 billion in annual revenue."

- Joe Matz, General Manager of Microsoft's World Wide Licensing and Pricing organization.¹²

This is perhaps the simplest migration scenario, and the one that delivers the greatest benefit with the least cost and risk. By moving existing Linux and Windows applications to larger and more scalable Itanium-based systems, organizations can typically scale their applications more easily to handle hundreds or thousands of users, massive workloads, and multi-terabyte data requirements, all while maintaining fewer system images and a more consolidated hardware environment.

Expert migration support is widely available from many system, OS, and application vendors, and many tools are available that help to automate data and code migration. No major OS change is required, and many data-tier software vendors support Itanium-based systems. This includes not only primary applications, but many dependent tools and utilities, as well. Interfaces tend to be very similar, and skill sets transfer easily between the two environments. For software components that have not yet been ported to Intel Itanium microarchitecture (and are not performance critical), the IA-32 Execution Layer enables Itanium-based servers to run native IA-32 code.¹³

Custom code, and packaged applications with numerous custom scripts, can be more challenging to migrate. If they are 32-bit applications, they will need to be ported to 64-bits. They will also need to be recompiled and optimized for Itanium-based systems. The Intel Software Network (www.intel.com/software) offers comprehensive tools, support, information, and training that can simplify these efforts.

¹² Read the full Intel case study: "Accelerating Data Delivery: Dual-Core Intel® Itanium® 2 Processor, SQL Server® 2005 Yield 8X Speedup for Microsoft:" www.intel.com/business/casestudies/microsoft_2.pdf

¹³ Performance is roughly comparable to a similarly clocked Intel Xeon processor-based system, and will rise proportionately with future processor advances. Though performance will vary with applications, expectations are that IA-32 EL performance will be roughly 50 to 70 percent of the performance of native Itanium-based applications.

Reducing Costs with UNIX on Itanium-based Systems

A number of Itanium-based system vendors support UNIX OS versions on Itanium-based systems. HP, for example, provides extensive tools and support for migrating HP-UX, NonStop, Open VMS, and other UNIX environments onto its Integrity line of Itanium-based servers. Tools and processes have been refined across thousands of successful customer migrations, so customers can move confidently onto an open, standards-based hardware architecture, while maintaining an identical or very similar operating environment. According to recent reports from Alinean, Inc., HP's Itanium-based solutions provide superior return on investment versus leading RISC/UNIX solutions.¹⁴ They also provide very flexible virtualization and partitioning capabilities, so that UNIX, Linux, and Windows applications can be integrated and managed on the same server.

For more information about HP migration services, visit:

<http://h20219.www2.hp.com/services/cache/114104-0-0-225-121.html>

Standardizing Proprietary UNIX Environments: Windows

"Microsoft's Windows Server operating system and servers using Intel's high-end processors have progressed to the point at which they can now satisfy the most demanding needs in terms of scalability and reliability."¹⁵

Companies are migrating away from proprietary UNIX/RISC platforms to reduce hardware and software costs, and to provide a more consistent and widely supported operating environment across their infrastructure. Windows is the number one destination of UNIX migrations, and interoperability between UNIX and Windows is far better than most IT organizations realize.¹⁶ According to recent research from Mercer Management Consulting, *"Unix customers report that it is often just as easy to migrate to a new platform (e.g., Windows or Linux) as it is to upgrade to new versions of Unix."*¹⁷

Windows skills are already widely represented in most organizations, and new tools and services will soon be available to dramatically simplify migration to Itanium-based systems. Most important, the

Case Study: RISC Migration in Action

CompUSA

- Migrated a mission-critical data warehouse to Itanium-based systems
- Sevenfold increase in cube processing speed
- Estimated to be half the cost of a comparable RISC-based solution

"Driving information delivery across the company is critical to our business success," says Dennis Naherny, Director of Enterprise Reporting for CompUSA, one of the world's leading retailers of technology products and services. To keep that information flowing in near real-time, CompUSA relies on the performance and reliability of a one terabyte data warehouse running on Microsoft SQL Server*.

In 2003, CompUSA migrated that warehouse from a 32-bit version of SQL Server to a 64-bit version running on Itanium-based servers, and realized an immediate sevenfold increase in cube processing speed. More recently, the company piloted a move to SQL Server 2005 on newer Itanium-based servers. Says Doug Gray, IT Director at CompUSA: ***"Every time I talk to the team, it's: Wow! SQL Server 2005 running on the latest-generation Itanium 2-based platform is better and faster every step of the way."*** He also reports that the cost of the system is roughly half that of a comparable RISC solution. With better and faster information handling, and a scalable and low-cost infrastructure, CompUSA now has a critical advantage in one of today's most highly competitive industries.

Read the complete Intel case study at:

http://www.intel.com/business/casestudies/compusa_2.pdf

¹⁴ To view the Alinean reports, and other information related to the TCO and ROI advantages of HP's Itanium-based systems, visit the HP web site at: <http://h20338.www2.hp.com/hpux11i/cache/324574-0-0-0-121.html>

¹⁵ Source: "Migrating Business-Critical Applications from UNIX to Windows and Itanium® 2-based Servers," by Ideas International, January 2006. www.itaniumsolutionsalliance.org/news/whitepapers_brochures/06_02_10_UNIX_to_Windows_Migration_FinalFinal_0.pdf
Microsoft Windows Server 2003 Datacenter Edition supports SMP servers with up to 64 processors and includes a number of scalability, high availability, and workload management features designed for enterprise-class solutions.

¹⁶ According to a report by Ideas International, *"Although UNIX and Windows are fundamentally different operating systems in many ways, interoperability between the two systems did not present major difficulties for the users who had migrated from one to the other, especially when their workloads were based on third-party software that supports multiple platforms."* Source: "Migrating Business-Critical Applications from UNIX to Windows and Itanium® 2-based Servers," by Ideas International, January 2006. www.itaniumsolutionsalliance.org/news/whitepapers_brochures/06_02_10_UNIX_to_Windows_Migration_FinalFinal_0.pdf

¹⁷ Source: "Driving Lower TCO and Rapid ROI through UNIX Migrations, Mercer Management Consulting," May, 2006.

Case Study: Mainframe Services in Action

Lufthansa

- Migrated revenue-critical systems to Itanium-based servers
- Enhanced revenue optimization across 1,800 daily flights
- Realized fast payback, with reduced capital, operational, and software licensing costs

As a premium airline operating in a tough market, Lufthansa relies on a sophisticated revenue management system to optimize profitability across its 1,800 daily flights. ***"The trick is to predict demand and get the best possible price for seats,"*** says Dr. Marcus Frenz, VP of IT Management for Lufthansa. To take profitability to the next level, Lufthansa extended its application to enable optimization across each customer's complete itinerary, a move that required a major upgrade in compute power.

To deliver this power cost-effectively, the company deployed its new O&D Optimizer application on a cluster of Itanium-based servers, and then migrated its O&D Forecaster application, as well. According to Arno Kumpf, the Lufthansa project lead, ***"...the superior price/performance ratio delivered by the Intel Itanium 2 processor-based HP Integrity Superdome* infrastructure has undoubtedly transformed our revenue management system. The things we're doing today we couldn't even consider doing a few years ago..."*** With better information and a company-wide focus on quality and efficiency, Lufthansa is thriving. While the overall aviation industry endured yet another year of loss, Lufthansa increased its revenue 7.5% in 2005, and its passenger numbers continue to swell.

Read the complete Intel case study at:

http://cache-www.intel.com/cd/00/00/32/32/323218_323218.pdf

upcoming "Longhorn" server release for Itanium-based systems will include Microsoft Subsystem for UNIX-based Applications (SUA) and other UNIX compatibility technologies. SUA provides a complete UNIX environment and true UNIX functionality without any emulation. It also supports flexible, cross-platform management, as well as security, directory, and file/print integration. Existing UNIX code can even be maintained, extended, debugged, and ported using Microsoft Visual Studio, which dramatically simplifies and accelerates new development and integration.

With this support, many existing UNIX applications can be recompiled to run natively on Windows with little or no change to original source code (even Perl and shell scripts will run seamlessly). Applications can then be ported in a phased migration, with very little downtime or disruption.

IT organizations can expect strong and ongoing support from Microsoft for Itanium-based solutions. As one example of its commitment, Microsoft has stated that it will deliver the Itanium-based version of Windows Server "Longhorn" on the same schedule as for Intel Xeon processor-based servers.

For more information, visit the Microsoft Web site:

www.migrationforunix.com/

Standardizing Proprietary UNIX Environments: Linux

"Transitive's family of software migration products dramatically reduces the obstacles users face when switching hardware platforms, allowing them to preserve their software investments so that the expense and time involved in porting code is minimized."

- Tony Iams, Lead Analyst, VP and Senior Analyst, IDEAS International¹⁸

The openness and affordability of Linux, and its similarity to UNIX, makes Linux on Itanium-based systems a popular target for modernizing legacy UNIX/RISC systems. Extensive support is available from many sources, including Red Hat, Novell, major Itanium-based hardware and software vendors, service providers, and Gelato.org, an open source community focused specifically on the Linux operating system running on Itanium-based systems.

¹⁸ Source: Transitive Web site: www.transitive.com/news/analyst_quote_iamsl.htm

Breakthrough migration support will soon be available in the form of Transitive Corporation's QuickTransit for Solaris/SPARC-to-Linux/Itanium* (Figure 2). With this binary translation software, businesses can:

- Run existing 32-bit and 64-bit Solaris/SPARC applications, including packaged applications, custom applications, and scripts—without any source or binary software changes.
- Run translated applications side-by-side with native applications.
- Maintain existing user interfaces, so changes are completely transparent to end users.
- Receive faster performance than today's fastest SPARC-based servers, and 2 to 4 times the performance of most currently deployed systems.¹⁹

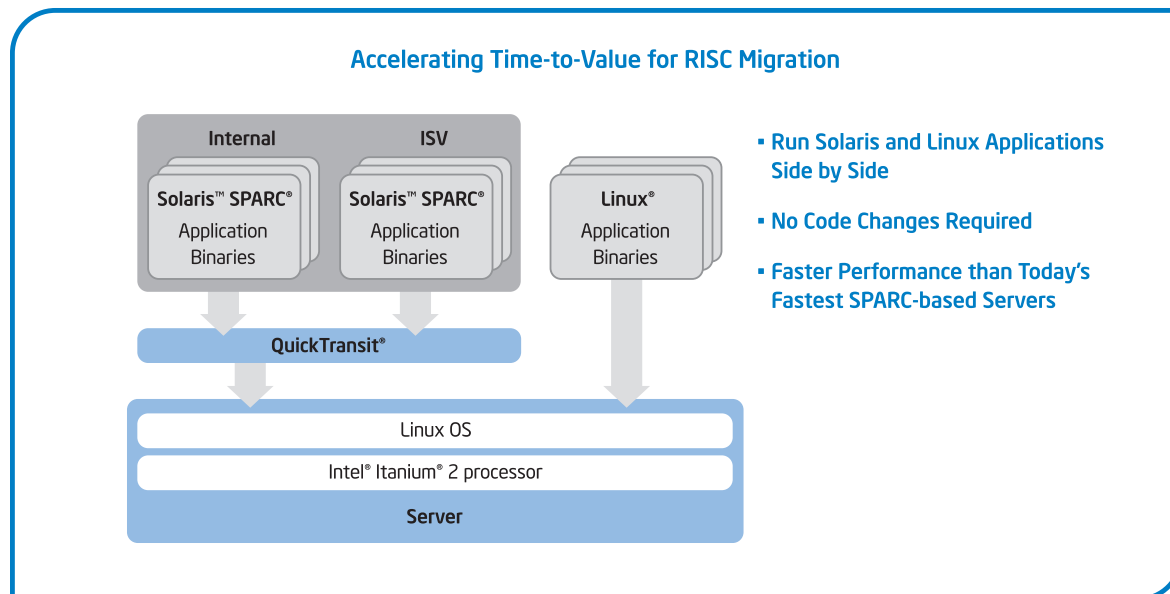
With these capabilities, the cost and risk of migrating Solaris*/SPARC* applications to Linux environments running on Itanium-based systems is dramatically reduced.²⁰ The Transitive product is based on proven technology, is currently in beta testing, and is already being used by major customers in the financial services²¹ and telecom industries. Transitive has been working extensively with leading server vendors to provide Solaris application compatibility as a pre-integrated option in Itanium-based systems, and currently expects general availability in the first half of 2007.

For more information, visit the Transitive Web site at:

www.transitive.com/products/sol_itanium.htm

Another important resource is the HP Solaris-to-Linux Porting Kit*, which automates 90 to 95 percent of code migration and enables both UNIX and Linux versions to be supported from the same source

Figure 2. With Transitive Corporation's binary translation software, legacy Solaris applications can run on Itanium-based systems with no code changes and near-native performance.



¹⁹ According to the Transitive Web site: "Because QuickTransit technology is a translator the application runs very fast, almost like a native port. Applications will perform about 110% of the fastest UltraSPARC IV+(1.5Ghz). The performance advantage is even greater—200% to 400%—when compared against the typical installed base (UltraSPARC III and UltraSPARC II)." www.transitive.com/products/faq.htm

²⁰ Transitive's binary translation technology is being used by SGI to run Irix* applications on Itanium-based systems (www.transitive.com/products/mips_itanium.htm); by Apple Corporation to run Macintosh applications on Intel® Core Duo processor-based PCs (www.transitive.com/customers/apple.htm); and by many companies to run Solaris applications on Intel Xeon processor-based servers (www.transitive.com/products/sol_sparc_lin_x8664.htm). QuickTransit for Solaris/SPARC-to-Linux/Itanium* supports the full UltraSPARC instruction set, including V8, v8+ and V9, and Solaris 2.6 and above, and runs on Red Hat Linux AS4 and SuSE SLES 10, or any Linux kernel later than 2.6.9. Transitive offers a comparable product for running Solaris SPARC applications on Intel Xeon processor-based servers: QuickTransit for Solaris/SPARC-to-Linux/Xeon*, www.transitive.com/products/sol_xeon.htm

²¹ Transitive Corporation was awarded Morgan Stanley's Innovation Aware for its QuickTransit product. According to Guy Chiarello, Morgan Stanley CIO, "At Morgan Stanley, we take an aggressive approach to evaluating new technology, both as a business enabler and as a lever for business growth, and we have evaluated QuickTransit products within our own infrastructure. By enabling immediate software migration to chosen strategic server platforms, we believe that Transitive can help eliminate much of the difficulty and expense that companies face when upgrading hardware." Source: "Transitive Press Release," July 31, 2006. www.transitive.com/news/news_20060731.htm

code. HP also provides comprehensive support for migration, along with an automated code scanning tool that provides a quick and accurate assessment of migration complexity.

For more information, visit the HP Web site at:

http://devresource.hp.com/drc/topics/solaris_linux.jsp

Modernizing Mainframe Environments

"...PSI's unique ability to have all of these platforms [z/OS, Linux, Windows] co-exist on the same server provides enterprise customers with unprecedented and hard-to-ignore opportunities."

– Anura Gurugé, Arcati Mainframe Yearbook 2006²²

An estimated two-thirds of all corporate data reside on mainframes, and there is growing concern among companies that the inflexibility of these systems, along with the growing cost and risk of maintaining them, is having a negative impact on competitive business capabilities. These concerns are exacerbated by the projected shortage of software developers over the next decade as the generation of experienced COBOL programmers reaches retirement age.²³

Several Itanium-based solution vendors (Fujitsu, HP, Microsoft, PSI, Unisys, and others) are focused on helping organizations support,

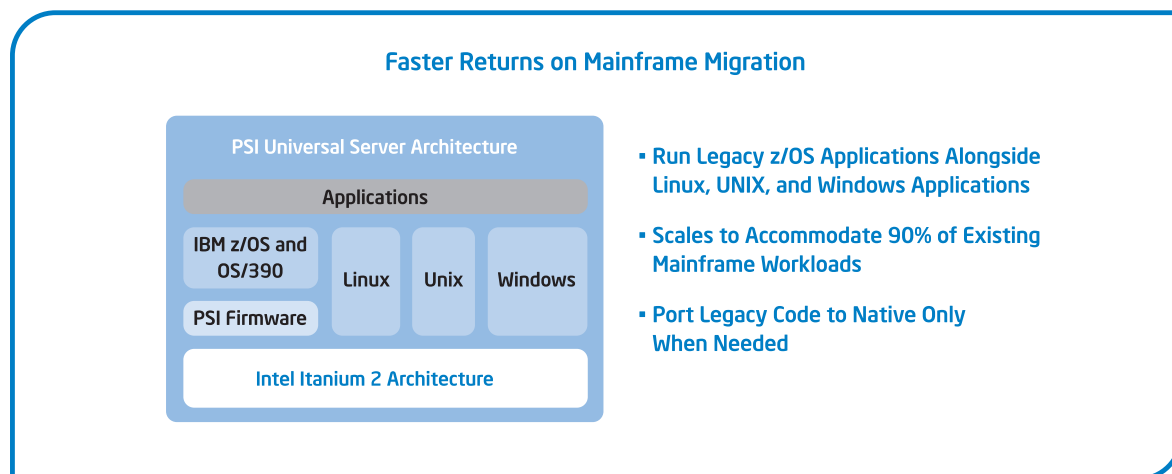
extend and migrate legacy mainframe systems and applications in ways that modernize the infrastructure while leveraging existing assets. Businesses will take several paths toward modernization, including moving existing code to new platforms, modernizing code through SOA and Web services, replacing legacy code with off-the-shelf applications, and porting code to newer and more broadly supported languages.

Itanium-based solution vendors offer support for all these strategies, along with hardware and software platforms that deliver the scalability, availability and manageability of traditional mainframe systems, with greater flexibility and lower TCO. As one example, Platform Solutions, Inc. offers Itanium-based mainframes that can run legacy z/OS applications side-by-side with Linux and Windows applications (Figure 3). With the new Dual-Core Intel Itanium 2 processor, PSI Open Mainframe* systems can scale to match the capacities of more than 90 percent of the mainframe servers currently in use.²⁴ This provides unprecedented flexibility for updating existing code on more affordable systems, so companies can port legacy code to Windows or Linux if and when desired.

PSI has already shipped pre-release systems to a number of major enterprise customers, and anticipates general availability in early 2007.

For more information, visit: www.platform-solutions.com/

Figure 3. Itanium-based mainframes from Platform Solution, Inc. greatly simplify mainframe modernization and integration, allowing companies to run their legacy applications right alongside their Linux, Unix, and Windows applications.



²² Access the complete "Arcati Mainframe Yearbook 2006" at: www.arcati.com/yearbook.html

²³ According to Gary Anthes, of ComputerWorld: "The persistence of Cobol—welcome or not—presents a dilemma for many companies. Their legacy code will require significant resources for years to come, yet younger software developers often don't want to work with Cobol, and in most cases, they're no longer learning it in school. And while there are thousands of Cobol coders still in the workplace, a large percentage of them are nearing retirement age." Source: "Cobol Coders: Going, Going, Gone?" by Gary Anthes, ComputerWorld, October 9, 2006. www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=266228

²⁴ Based on an analysis by PSI of the worldwide installed base of mainframes in 2006 using market estimates from a leading industry source.

Getting Started

***"While the proliferation of porting tools makes the process easier (in some cases almost trivial), migrations must be planned as carefully as any other major IT effort."**²⁵*

Taking advantage of the flexibility and affordability of Itanium-based systems begins with three basic steps.

1. **Assess your environment** to find business-critical, data-intensive enterprise or technical applications that are nearing end of life, due for consolidation, in need of overhaul to address changing business requirements, or are not meeting expectations in terms of performance, scalability, availability, adaptability, or cost.
2. **Determine whether Itanium-based servers are a viable choice for migration.**

For packaged applications, check with your software vendor or visit the Itanium Solutions Catalog at:

www.itaniumsolutionsalliance.org/kshowcase/view

For custom applications, check with your preferred Itanium-based server or OS vendor for support, or with Intel Solution Services (<http://www.intel.com/cd/services/intelsolutionservices/asm-na/eng/index.htm>), the Itanium Solutions Alliance (<http://www.itaniumsolutionsalliance.org/home>) or Gelato.org.

For particular vertical industries or application types, visit the Itanium Solutions Alliance Web site at:

www.itaniumsolutionsalliance.org/itanium/materials/

or the Intel Web site at:

www.intel.com/business/itanium/success_stories.htm

for pertinent case studies and white papers.

3. **Conduct quantitative ROI and TCO analyses**, as well as a technical feasibility assessment, for migrating to Itanium-based systems. Compare the cost, complexity, and risk of migrating with the cost, complexity, and risk of upgrading the existing architecture. Consider working with an experienced vendor at this point to simplify and accelerate the process and reduce risk.

For a high-level overview of best practices that can help to reduce the effort and risk of migration, see *Appendix A*.

Case Study: RISC Migration in Action

Hyundai Heavy Industries (HHI)

- Migrated core CAE applications to Itanium-based servers
- Reduced overall time for analyzing ship designs from 15 days to 2 days
- Increased shipbuilding capability by up to 233 percent

There is a growing need for ultra-large ships for cargo transportation, and Hyundai Heavy Industries has been gearing up to meet that demand. But, the company's core computer-aided engineering (CAE) application was already operating at full capacity. Time-lags in running the complex simulations required for design, analysis, and virtual testing were limiting HHI's ability to scale its shipbuilding capacity.

After extensive benchmark testing, the company chose a 32-processor Itanium-based server to replace its aging RISC-based system. Stability and cost were important criteria in the system choice, but high performance was even more essential. According to Jin Chil Kwon, General Manager of the Shipbuilding Design Department, ***"Analyzing ship design and construction using the CAE application previously took approximately 7 to 15 days; now it takes only 28 hours."*** With the new system in place, HHI has more than doubled its shipbuilding capability (from 30 ships per year to 70), and is clearly on track to maintain its number one position in the global marketplace.

Read the complete Intel case study at:

www.intel.com/business/casestudies/hyundai_heavy.pdf

²⁵ "Itanium 2 Developer Days Diary: Insider Tips and Tricks for Porting Applications to Itanium 2-based Architecture," by Robin Drummond, April 27, 2006. www.ddj.com/dept/64bit/187000299?pgno=1

Conclusion

Companies are migrating to Itanium-based solutions across a broad range of operating environments to reduce costs, improve performance, scalability, and availability, and provide a more flexible architecture for future growth. Though the risk and complexity of a major migration should never be underestimated, new and emerging tools can greatly simplify and accelerate the move to Itanium-based systems. Even more important is the broad ecosystem of hardware, software, and services that are available to support migrations, new deployments, and ongoing operations.

More than 75 of the world's 100 largest companies have already deployed major business applications on Itanium-based systems, and adoption continues to accelerate around the globe. Joining the move may be easier than you think, and may help you substantially reduce IT costs, while positioning your business for faster and more efficient growth in the years ahead.

Appendix A: Best Practices for Migration

The following recommendations are based on a major SAP migration to Itanium-based servers conducted by Intel's own IT organization. For more information, see the IT@Intel white paper, "Migrating Order Management to Itanium® 2-based Servers." www.sap.com/company/events/pdf/Migrating_Order_Mgmt.pdf

Note: For major migrations, most organizations will benefit from working with an experienced vendor or service provider.²⁶ Be sure to select a vendor that offers comprehensive support, a proven track record, and a strong roadmap for Itanium-based products and services.

1. **As legacy systems reach the end of their lifecycle, assess the value of a move to Itanium-based solutions.** Compare the cost of acquiring new systems on the same architecture to the cost of comparable Itanium 2-based solutions. Include quantitative TCO and ROI analyses to illuminate the differential costs of hardware, software, migration, maintenance, and support.
2. **Consider the full range of OS options (UNIX, Linux, Windows, z/OS, etc.).** Be aware that migrations are simplest when moving to the same or a similar OS, but may deliver better flexibility and long-term value when moving to a more standards-based and widely supported environment, such as Windows or Linux.
3. **Inventory your existing solution.** Your analysis should include not only primary systems and software but also secondary components, such as runtime environments, drivers, utilities, storage systems, etc. Also consider dependencies with databases, middleware, security, and management infrastructure.
4. **Determine the degree of support for Itanium-based solutions** and identify any gaps that will need to be resolved, as well as training requirements for migrating, maintaining, and using the new solution. If gaps exist, alternative vendors may need to be identified. Alternatively, consider running dependent 32-bit applications using the IA-32 Execution Layer, but be sure to check on vendor support for running in emulation mode.
5. **Assess the quantity and complexity of your custom applications and scripts.**²⁷ Determine if they will need to be ported, or if they can be run without change or with a simple recompile using available software tools. If porting is required, identify appropriate tools and procedures.
6. **Determine test and validation plans.** Define performance metrics that are meaningful in terms of real business results.
7. **Investigate industry benchmarks for sizing estimates,** and follow up with proof-of-concept testing on realistic workloads. (Look into the Intel® Remote Access and Intel® Early Access programs for accessing state-of-the-art development and testing environments.)
8. **Determine uptime requirements for your application(s),** and consider the advanced RAS options of Itanium-based solutions.²⁸

²⁶ As reported by IDC, "End-users can benefit from vendors that can transfer years of experience, know-how and skill with x86 standardization to Itanium servers." Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-based Standardization," August 2005: www.itaniumsolutionsalliance.org/news/whitepapers_brochures/CG18M_Web.pdf

²⁷ Consider the use of application portfolio management (APM) and mining tools to simplify this process. According to Forrester, emerging APM tools offer major IT benefits, not only for migration assessments, but for greatly reducing the organizational knowledge loss that makes legacy applications so challenging to maintain. See: *Java, COBOL, And Perl Share A Common Problem*, by Phil Murphy with Kimberly Q. Dowling, Forrester Research, Inc., November 11, 2005. Available for purchase at: <http://www.forrester.com/Research/Document/Excerpt/0,7211,38182,00.html>

²⁸ For information about the RAS capabilities of Itanium architecture, read the Intel white paper: Mainframe Reliability at Mainstream Prices. http://www.intel.com/business/bss/products/server/itanium2/mainframe_reliability.pdf

9. **Conduct a small pilot deployment to uncover potential challenges.** Load and test applications in stages, beginning with the OS and core applications, then adding infrastructure elements (virus protection, backup and restore, management, disaster recovery, etc.) This will make it easier to isolate and resolve any issues that arise. Working with a select group of end-users during final testing can help to evaluate training requirements.
10. **Tune your solution to optimize performance and scalability.** Intel offers a suite of software optimization tools that integrate easily into existing development environments and may substantially improve application performance.²⁹

Appendix B: Additional Resources

For more papers, articles and case studies, visit the Itanium Solutions Alliance Web site (www.itaniumsolutionsalliance.org/news/whitepapers_brochures/); or the Intel Web site (www.intel.com/business/bss/products/server/itanium2/index.htm); or the HP Web site (<http://h20341.www2.hp.com/integrity/cache/405499-0-0-0-121.html>).

Novell: Porting and Migration Tools:

http://developer.novell.com/wiki/index.php/Porting_and_Migration_Tools

"Driving Lower TCO and Rapid ROI through Unix Migrations," Mercer Management Consulting, May, 2006: www.migrationforunix.com/futureproof/downloads/mercer-white-paper.pdf

"Migrating Business-Critical Applications from UNIX to Windows and Itanium® 2-based Servers," an Ideas International white paper, January 2006: www.microsoft.com/windowsserver/facts/analyses/bizcrit.msp

"Unix-to Linux-migration: An Introduction," a Red Hat white paper: www.redhat.com/whitepapers/migration/U2L_migration_FINAL.pdf

"End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-based Standardization," an IDC white paper sponsored by HP, August, 2005: www.itaniumsolutionsalliance.org/news/whitepapers_brochures/CG18M_Web.pdf

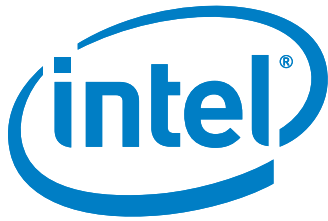
"Migrating Unix ERP Installations to a Windows Server Environment: A Qualitative Assessment of Business Impact," a META Group white paper: <http://download.microsoft.com/download/f/5/f/f5fcd06a-dafd-4f45-ab4d-bdd2da2b2e86/METAGroup.pdf>

"Itanium 2 Developer Days Diary": www.ddj.com/dept/64bit/187000299?pgno=1

"Migrating Order Management to Itanium® 2-based Servers," an IT@Intel white paper, March 2005: www.sap.com/company/events/pdf/Migrating_Order_Mgmt.pdf

"The Weather Channel: Measuring Business Value from Server Migration to Linux and A Tiered-Storage Model," A Business Value Analysis by e-Business Strategies, Inc., 2005: http://eval.veritas.com/mktginfo/enterprise/customer_successes/ent-the_weather_channel_2005.pdf

²⁹ For information about Intel Software Development Tools, visit the Intel Web site at: <http://www.intel.com/cd/software/products/asmo-na/eng/index.htm>



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